California High-Speed Train Program EIR/EIS

TASK 2.3.1R

LOS ANGELES TO SAN DIEGO VIA ORANGE COUNTY
High-Speed Train Alignments/Stations Screening Evaluation

REVISED DRAFT

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ACRONYMS

Authority	California High Speed Rail Authority
BNSF	Burlington Northern Santa Fe Railway
Caltrans	California Department of Transportation
CDFG	California Department of Fish and Game
CEM	Crash Energy Management
CEQA	California Environmental Quality Act
CTA	Central Terminal Area (LAX)
DOT	Department of Transportation
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
FAA	Federal Aviation Administration
FRA	Federal Railroad Administration
GIS	Geographic Information Services
HOV	High Occupancy Vehicle
HS	High Speed [Train]
I-#	Interstate #
ICE	InterCity Express (Germany)
ITC	Irvine Transportation Center
JPA	Joint Powers Authority
Km/h	Kilometers per hour
LA	Los Angeles
LADOT	Los Angeles Department of Transportation (City of Los Angeles)
LAWA	Los Angeles World Airports
LAX	Los Angeles International Airport
LOSSAN	Los Angeles to San Diego
LRT	Light Rail Transit
Maglev	Magnetic Levitation
MAP	Million Annual Passengers
MCAS	United States Marine Corps Air Station
MOS	Minimum Operating Segment
Mph	Miles per hour
MTA	Los Angeles County Metropolitan Transportation Authority
MTDB	Metropolitan Transportation Development Board (San Diego County)
NCTD	North County Transit District (San Diego County)
NEPA	National Environmental Policy Act
NRCS	United States Natural Resources Conservation Service
OC	Orange County
OCTA	Orange County Transportation Authority
OTC	Oceanside Transportation Center
PE	Pacific Electric Railroad
ROW	Right-of-Way

RTP	Regional Transportation Plan
SARC	Santa Ana River Channel
SANDAG	San Diego Association of Governments
SCAG	Southern California Association of Governments
SCR	Senate Concurrent Resolution
SCRRA	Southern California Regional Rail Authority (Metrolink)
SDNR	San Diego Northern Railway
SR-#	State Route #
UCI	University of California, Irvine
UCSD	University of California, San Diego
UP	Union Pacific Railroad
USFWS	United States Fish and Wildlife Services
UTC	University Towne Centre
VHS	Very High Speed [Train]

S.0 SUMMARY

Following adoption of a *Final Business Plan*[1] in 2000, the California High-Speed Rail Authority (Authority) recommended the state proceed with implementation of a statewide high-speed train system by initiating the formal state and federal environmental review process through the preparation of a state program-level Environmental Impact Report (EIR) and a federal Tier I Environmental Impact Statement (EIS) or Program EIR/EIS. The Authority is the state lead agency for the California Environmental Quality Act (CEQA) and the Federal Railroad Administration (FRA) is the federal lead agency for the National Environmental Policy Act (NEPA). As part of the Program EIR/EIS, a number of project alternatives will be evaluated including a High-Speed Train Alternative. Within the High-Speed Train Alternative, there is a range of high-speed train alignment and station location options to be considered.

The purpose of this High-Speed Train Alignments/Stations Screening Evaluation is to consider all reasonable and practical options within the Los Angeles-Orange County-San Diego corridor at a consistent level of analysis and focus the Program EIR/EIS on those alignment and station options that best attain the following objectives established by the Authority:

- Maximize Ridership/Revenue Potential
- Maximize Connectivity and Accessibility
- Minimize Operating and Capital Costs
- Maximize Compatibility with Existing and Planned Development
- Minimize Impacts to Natural Resources
- Minimize Impacts to Social and Economic Resources
- Minimize Impacts to Cultural Resources
- Maximize Avoidance of Areas with Geological and Soils Constraints
- Maximize Avoidance of Areas with Potential Hazardous Materials

This alignment and station screening evaluation was accomplished through the following key activities:

- Confirmation/reconsideration of past alignment and station decisions based on review of previous studies.
- Identification of alignment and station options not previously evaluated through meetings with elected officials and public agencies and through the environmental scoping process.
- Evaluation of alignment and station options using standard engineering, environmental, and financial criteria and evaluation methodologies.
- Identification of the alignment and station options' ability to attain defined objectives.

S.1 ALIGNMENT AND STATION OPTIONS STUDIED

Of the five corridors being studied by the Authority, the Los Angeles – Orange County – San Diego corridor is unique in that it contains, from end to end, an existing intercity passenger rail corridor – the Los Angeles to San Diego (LOSSAN) corridor. In terms of passenger volumes, the LOSSAN corridor is Amtrak's second-busiest corridor in the nation, after the Northeast Corridor connecting Washington, D.C. to New York City. It is used by Amtrak for the State-supported Pacific Surfliner Service between Los Angeles and San Diego, by the Southern California Regional Rail Authority for its Metrolink commuter rail service in Los Angeles and Orange Counties, and in San Diego County by the North County Transit District for its Coaster commuter rail service. Burlington Northern Santa Fe also uses the corridor for freight service.

[1] California High-Speed Rail Authority. *Building a High-Speed Train System for California, Final Business Plan*. June 2000.

The presence of the LOSSAN corridor provides an excellent opportunity, as it raises the possibility of building a high-speed train system by incrementally improving an existing service, including the possibility of using conventional fossil-fuel trains rather than electrically powered steel-wheel-on-steel-rail or Maglev technologies. Therefore, in addition to considering alignment options, this study examines two levels of incremental improvements to the LOSSAN corridor that would support different levels of high-speed service, as alternative high-speed train "build" options.

However, the corridor also poses some considerable constraints. It passes through one of the most densely populated areas of the State and, in southern Orange County and San Diego County, traverses ecologically sensitive coastal areas. Due to these significant environmental and community constraints, the LOSSAN options would not be dedicated services. The options either require high-speed trains to share tracks with existing Amtrak, commuter rail and freight service, or would be a separate "feeder" service that would require a transfer to the rest of the high-speed network, at LA Union Station or in Orange County.

As studied in this report, the range of LOSSAN options are bracketed by the following two representative configurations:

1. LOSSAN Configuration A - Upgrade the existing LOSSAN corridor with full double-tracking and partial grade-separation to allow rail services to operate at up to 125 mph (200 km/h). All existing Amtrak stations would continue to be served by both existing and high-speed trains. This option assumes a conventional fossil-fuel train system that would not be compatible with the rest of the statewide network. This would require passengers to transfer to and from the rest of the statewide train system at LA Union Station in Los Angeles. Within this screening evaluation, this configuration is represented by alignment options B1a, C1a, and D1a.

2. LOSSAN Configuration B - Upgrade the LOSSAN corridor to full high-speed train standards, including complete grade separation, to permit rail services to travel over 125 mph (200 km/h) in some areas, and allow through-running of trains from other parts of the statewide system. High-speed trains would serve only designated stations, with bypass tracks provided where feasible at all stations including existing Amtrak and commuter rail stations to facilitate express operations. Due to the existing geometry of the LOSSAN corridor, and requirement for shared-use, speeds will not be as high as proposed for other segments of the statewide network. This configuration includes alignment options B1b, C1b, and D1b, and represents the highest level of capital improvements studied for an electrified, fully grade-separated system. The physical upgrades embodied in this option can occur with or without electrification. Without electrification, the "b" option encompasses the highest level of capital improvements studied with a conventional fossil-fueled system.

For the sake of simplicity the LOSSAN "a" and "b" options are discussed throughout this report as two distinct options. However, they should be seen as two bookends in what is in fact a continuous spectrum of design options. By drawing selectively from different elements of "a" and "b" in different parts of the corridor, it would be possible to configure a large number of distinct options between the two extremes discussed in this report.

The set of LOSSAN improvements proposed in the Amtrak 20-Year Plan[2] and in the Authority's *Final Business Plan* also fall within the range of the "a" and "b" options. Generally, the Amtrak plan is more closely related to the "a" option, while the Business Plan improvements are closer to the "b" option, but each represents a different mix of elements from both the "a" and "b" options.

[2] Parsons Brinckerhoff. *California Passenger Rail System 20-Year Improvement Plan*. Prepared for Amtrak, March 2001.

Beyond upgrading the LOSSAN corridor, this study also examines a set of alignments within dedicated rights-of-way for the Los Angeles to San Diego coastal corridor. In addition, several alignments are studied to see if a high-speed connection between Los Angeles International Airport (LAX) and LA Union Station would be feasible. These dedicated alignments would be fully compatible with the rest of the statewide system.

Figure S-1 shows the alignment and station options within this corridor. In all, the options encompass a system from Los Angeles to San Diego via Orange County that would be about 117 to 123 miles (189-198 km) long, and could potentially carry passengers between the two points in 72 to 78 minutes.

The Los Angeles-Orange County-San Diego corridor was divided into four segments for analysis purposes. The endpoints of the segments are the stations closest to the points where the alignment options join or cross each other: LAX, LA Union Station, Central Orange County (Anaheim), Oceanside, and San Diego. The four segments include: LA Union Station/Southeast LA County to LAX, LA Union Station to Central Orange County (Anaheim), Central Orange County (Anaheim) to Oceanside and Oceanside to San Diego.

S.1.1 Segment A – LA Union Station/Southeast LA County to LAX

Three alignment options were considered to provide stand-alone or through service from LA Union Station to LAX.

- Alignment Option A1 - Interstate 405 And Interstate 10: This alignment would use existing freeway corridors from LA Union Station to LAX. The alignment allows for the possibility of adding a station to serve west Los Angeles communities in the future. This option would be a dedicated high-speed system. Station options include LA Union Station and LAX (near Terminal One).
- Alignment Option A2 - MTA Harbor Subdivision: This option would follow an existing rail alignment for most of the segment from LA Union Station to LAX. The Authority previously studied this option. Station options include LA Union Station and LAX (near Terminal One).
- Alignment Option A3 - Interstate 105 And Interstate 110. This is a southern freeway alignment option for Option A1, for the connection from LA Union Station to LAX. This option would be a dedicated high-speed system. Station options include LA Union Station and LAX (near Terminal One).

Two other options were considered, connecting LAX to southeast Los Angeles County instead of LA Union Station:

- Alignment Option A4 - Upgrade MTA Green Line To Support High Speed Train: This option would require upgrading the existing MTA Green Line to allow for higher speed trains to operate shared-use with light rail.
- Alignment Option A5 - MTA Green Line Extension: For this option, an extended Green Line would provide a light rail connection to LAX from a southeast LA County high-speed train station.

As with all segments, the No Build scenario is a potential candidate here. In this scenario, passengers would use existing shuttle bus, taxi and rental car services and the existing freeway High Occupancy Vehicle (HOV) system to travel between LA Union Station and LAX.

Figure S-2 illustrates the build options and summarizes their key distinguishing features, while Tables S-1 and S-2 rate each of the alignments and stations against the Authority's key objectives.

All three direct-connection options to LAX (Options A1, A2 and A3) provide comparable travel times of 14-18 minutes. Similarly, all are costly, due largely to the need for extensive trenched or aerial construction necessitated by constrained rights-of-way and adjacent residential neighborhoods. All three travel through areas housing significant minority and low-income populations, raising significant environmental justice issues.

Although the travel time between LA Union Station and LAX would be relatively quick, the convenience of the trip is questionable. Due to the space requirements of a high-speed train station and the layout of terminals at LAX, it is not possible to provide direct station-to-terminal service to all terminals. Passengers alighting at LAX will likely need to transfer to a people mover, moving walkway or shuttle bus for the final journey to their terminals.

There are also significant operational issues at the LA Union Station end of the trip. At full build out of the high-speed train network, up to four lines could be converging at LA Union Station – Los Angeles north to the Bay Area and Sacramento, Los Angeles to San Diego via the Inland Empire, Los Angeles to San Diego via Orange County, and the LAX connection. It is unlikely and operationally undesirable to route all trains from all directions through LA Union Station and into LAX, meaning that high-speed train passengers will likely face a transfer at LA Union Station between high-speed trains to reach LAX. This double-transfer will reduce ridership.

Finally, based on conversations with members of the South Bay Council of Governments and other groups opposed to expansion of LAX, there is significant opposition to the concept of a high-speed train connection into LAX, due to growth-inducement concerns.

The second set of options involve providing an indirect connection to LAX via the MTA Green Line Light Rail System, which runs east-west along the I-105 alignment into the LAX area in the west, and Southeast Los Angeles County in the east. The option that considers shared-use of the Green Line tracks by HSR trains (Option A4) has significant regulatory and operational barriers, and would be no faster than transferring to the Green Line for passengers, as high-speed trains would be constrained to run between Green Line trains.

Extending the Green Line into LAX, and to a high-speed train station in Southeast LA County (Option A5) is the most cost-effective fixed-guideway option, between $700 million and $1.4 billion less expensive than the direct connections. However, it is significantly slower than a direct high-speed train connection and requires a transfer at either end of the trip. As mentioned above, the double-transfer would likely be the case for many passengers, even with a direct high-speed train connection.

Finally, the no-build alternative (i.e. relying on shuttle buses, taxis and automobiles) is the slowest of all options, but carries few if any additional costs or environmental impacts, and requires only one transfer at Union Station, as these modes provide direct-to-terminal service.

S.1.2 Segment B – LA Union Station to Central Orange County (Anaheim)

Between Los Angeles and Central Orange County, the LOSSAN corridor is available for consideration. Beyond the LOSSAN options, the key objective driving the consideration of other alignments in this segment is the desire to study a fully dedicated alignment that could provide direct, transfer-free service into Orange County. Three new alignment options were defined for this segment of the Los Angeles to San Diego corridor. All three options are dedicated corridors, to allow the high-speed trains to avoid the heavy freight and commuter rail traffic on the existing LOSSAN corridor from Los Angeles to Fullerton. Such dedicated options can be compared to the incremental shared-track improvements to the LOSSAN corridor as to cost, performance, community and environmental impacts.

- Alignment Options B1a and B1b - LOSSAN Corridor: Option B1a would include a minimum of three main tracks between LA Union Station and Fullerton, while Option B1b would include 4 tracks, to increase capacity and reliability of the rail corridor for high-speed trains and other rail traffic. Option B1b would also include full grade-separation, bypass tracks at all stations, and the possibility of electrification. Under option B1a, all existing Amtrak stations would be served. Station options for B1b include LA Union Station, Norwalk (Metrolink Station) and Anaheim (Edison Field Amtrak/Metrolink Station).
- Alignment Option B2 - Interstate 5 Freeway: This alignment would follow I-5 south of the East LA interchange. This would allow for a dedicated bypass of the freight and commuter rail corridor, and a reasonably direct alignment to Central Orange County. Station options for B2 include LA Union Station, Norwalk (I-5 at Imperial Highway) and Anaheim (I-5 near Gene Autry Way).
- Alignment Option B3 - Pacific Electric (PE) Right-Of-Way: This alignment is a lightly used rail line between Paramount and Stanton, and an abandoned corridor through to Santa Ana. Its long tangent sections could support high-speed train operation. Station options for B3 include LA Union Station, Paramount (PE ROW at I-105) and Garden Grove (PE ROW at SR-22).
- Alignment Option B4 - Union Pacific Santa Ana Branch Line: This option would use an existing Union Pacific (UP) branch line from southeast LA to Anaheim, where it would connect back to I-5 alignment. Station options for B3 include LA Union Station, Norwalk (UP Branch at Imperial Highway) and Anaheim (I-5 near Gene Autry Way).

Figure S-3 illustrates the build options and summarizes their key distinguishing features, while Tables S-3 through S-5 rate each of the alignments and stations against the Authority's key objectives.

The two shared-track LOSSAN improvements (B1a and B1b) provide similar travel times in the range of 18-19 minutes. Please note that these are express times, and do not account for delays that would be suffered due to sharing the corridor with other passenger and freight traffic. Actual travel times would likely be longer, and will be determined through detailed modeling in the next phase of work, should these options be selected for further study. The "a" option would require a transfer at LA Union Station to the statewide system for travelers headed north. The "b" option would also require the transfer if it were fossil-fueled; if electrified, transfer-free operations would be possible if high-speed train manufacturers are able to meet FRA regulations in the future.

Since they involve incremental upgrades to an existing system rather than building a new system, the two LOSSAN options are the least costly of the options in this segment, between $800 million and $1.6 billion less than the dedicated options. For a higher cost relative to option "a", option "b" provides improved operational reliability and performance via a fourth track in the section with heaviest freight traffic, complete grade-separation and, potentially, electrification.

The three dedicated options (B2, B3, B4) provide travel times that are similar to or slightly better than the LOSSAN options, in the range of 16 to 19 minutes. These times are more certain, since high-speed trains would not be sharing tracks with any other traffic. These options also assure the possibility of no-transfer operations at LA Union Station. Although the three options are located within generally the same natural and man-made environment as the LOSSAN options, the potential for significant impact is higher due to the more extensive construction required relative to the incremental upgrading of an existing facility.

Of the three dedicated options, B2 (I-5) is the slowest, due to the number and size of curves on the I-5 alignment. It is the second most expensive, due to extremely constrained right-of-way in the corridor, requiring aerial construction. It would provide a Central Orange County station in Anaheim, which would have good freeway access and intermodal transit connections.

Option B3 (PE Right-of-Way) is the fastest route, due primarily to its straightness. However, it is also the longest route, and the most expensive, due to long sections of abutting residential that will likely require trenched construction to mitigate impacts. The population and employment catchment area of the central Orange County station (in Garden Grove) is comparable to that of the other central Orange County stations of the other options, which are in Anaheim. However, the Garden Grove site performs less well as to access, since it is convenient to only a single freeway. The station site, like much of the alignment, is in a residential neighborhood. Finally, both the Orange County Transportation Authority and the Gateway Cities of Southeast LA County are currently studying this corridor as a potential local transit corridor.

Option B4 (the UP Santa Ana Branch Line) is the least costly of the three dedicated route options, since it traverses largely industrial and commercial areas where at-grade operations are more feasible. It too would provide a Central Orange County station in Anaheim, similar to Option B2. However, this option also has the highest incidence of minority populations of the three dedicated alignments, particularly through the cities of Vernon, Downey and Norwalk.

S.1.3 Segment C – Central Orange County (Anaheim) to Oceanside

Similar to Segment B, a key objective driving the consideration of other alignments beyond the LOSSAN options in this segment is the desire to study a fully dedicated alignment that could provide direct, transfer-free service further south into Orange County, or northern San Diego County. A second motivation to studying alternatives to the LOSSAN corridor is the fact that in this segment the LOSSAN corridor begins to run next to the coast in south Orange County. This is a highly constrained environment with the potential for significant impacts to coastal communities and sensitive environmental areas.

Therefore, several alternatives to the LOSSAN corridor were studied that would not only provide a dedicated high-speed train corridor, but would also avoid sensitive coastal areas. The alignments studied for this segment are continuations of the options described in Segment B.

- Alignment Options C1a AND C1b - LOSSAN Corridor: There are two options in the LOSSAN corridor. Option C1a would include upgrades within the corridor, including grade separation at San Juan Capistrano and San Clemente. Option C1b would include upgrades and bypass alignments around the environmentally sensitive coastal communities and regions of south Orange County. Under option C1a, all existing Amtrak stations would be served. Station options for C1b include the Irvine Transportation Center (ITC) and the Oceanside Transportation Center (OTC).
- Alignment Option C2 - Interstate 5 Freeway: This alignment would continue along I-5 in Orange County and through Camp Pendleton, providing a dedicated high-speed alignment and bypassing constrained sections of the LOSSAN corridor. Station options for C2 include Irvine (I-5 at Jeffrey Road) and Oceanside (I-5 at Oceanside Boulevard).
- Alignment Option C3 - San Joaquin Corridor (SR-73) With I-5: This would be a dedicated alignment option, continuing from the PE right-of-way in Garden Grove. This would be a southern highway alternative to Option C2 (which follows I-5 through Santa Ana, Tustin, and Irvine), and would pass through some less developed parts of Orange County. Station options for C3 include Newport Beach (SR-73 at Jamboree Road) and Oceanside (I-5 at Oceanside Boulevard).
- Alignment Option C4 - Interstate 5 And Foothill Corridor (SR-241): This option would use the right-of-way of the existing and proposed alignments of the SR-241 Toll Road in eastern Orange County. This alignment option would bypass the coastal communities of southern Orange County and join I-5 alignment from San Onofre to Oceanside. Station options for C2 include Irvine (I-5 at Jeffrey Road) and Oceanside (I-5 at Oceanside Boulevard).

Figure S-4 illustrates the build options and summarizes their key distinguishing features, while Tables S-6 and S-7 rate each of the alignments and stations against the Authority's key objectives.

Both shared-track LOSSAN improvements (C1a and C1b) provide comparable travel times of 32-34 minutes, again, likely understated since the constraints posed by other traffic on the line were not included. Again, relative to the other dedicated options they are the least costly, between $1 billion and $2.5 billion less than the dedicated alignments. For a higher capital cost relative to option "a", the "b" option provides a higher level of environmental mitigation by taking the tracks "off the beach" in San Clemente, and out of the historical downtown of San Juan Capistrano, and also straightens two slow curves in Orange and Dana Point.

The three dedicated options (C2, C3, C4) provide travel times that are similar to or slightly longer than the LOSSAN options, in the range of 34 to 37 minutes. These times are more certain, since high-speed trains would not be sharing tracks with any other traffic. These options assure the possibility of no-transfer operation at LA Union Station.

Option C2 (I-5) is the fastest of the dedicated options. It is also the costliest, since the number and size of horizontal and vertical curves on I-5 require extensive aerial and tunnel construction to maintain speeds. This option avoids the sensitive areas in San Juan Capistrano and San Clemente, although there is the potential for impact alongside the I-5 corridor, which is abutted by commercial and industrial uses in both areas.

Option C3 (San Joaquin Corridor) is almost as expensive as the I-5 option due to its rolling terrain, which requires extensive tunneling. The population and employment catchment area of the south Orange County station (in Newport Beach) is comparable to that of the other south Orange County stations of the other options, which are in Irvine. However, the Newport Beach site performs less well as to access, since it is convenient to only a single freeway. In addition, the station site is in an area of residential development and open space, raising concerns about visual and land use compatibility.

Option C4 (Foothill Corridor) is the least costly of the three dedicated route options, due to the possibility of joint construction with the proposed extension of the Foothill Corridor. However, it is also the longest and slowest of the three. Finally, the availability of this option is uncertain, as it depends on the extension of the Foothill corridor, a toll road project that is environmentally controversial and uncertain.

S.1.4 Segment D – Oceanside to San Diego

Similar to Segment C, the key objectives driving the consideration of other alignments beyond the LOSSAN corridor in this segment are the desire to study a fully dedicated alignment that could provide direct, transfer-free service into San Diego County, and to avoid sensitive coastal areas. The alignments studied for this segment are primarily continuations of the options described in Segment C.

In San Diego County only two distinct alignments were studied: LOSSAN and I-5. Due to the terrain and pattern of residential development in coastal San Diego County, no other options were determined feasible.

- Alignment Options D1a and D1b - LOSSAN Corridor: Option D1a would include the tunnel under University Towne Centre (UTC) from the *Corridor Evaluation*[3]. Option D1b would include a tunnel under Camino Del Mar, and a more direct tunnel alignment under I-5 instead of UTC, to increase speed. Under option D1a, all existing Amtrak stations would be served, and there would be a new

[3] Parsons Brinckerhoff. *California High-Speed Rail Corridor Evaluation.* Prepared for California High-Speed Rail Authority, December 1999.

station at University Towne Centre (La Jolla Village Drive and Genesee Avenue). Station options for B1b include Solana Beach (Amtrak/Coaster Station) and the Santa Fe Depot in downtown San Diego.

- Alignment Option D2 - Interstate 5 Freeway: This would be the only freeway option for a dedicated high-speed alignment along the coast in San Diego, and would allow bypassing of sensitive coastal areas along the LOSSAN corridor. Station options for D2 include Solana Beach (I-5 at Lomas Santa Fe Drive) and San Diego Airport.

Figure S-5 illustrates the build options and summarizes their key distinguishing features, while Tables S-8 through S-12 rate each of the alignments and stations against the Authority's key objectives.

Both shared-track LOSSAN improvements (D1a and D1b) provide comparable travel times of 23-24 minutes, again, likely understated since the constraints posed by other traffic on the line were not included. Option "b" is slightly faster since it takes a more direct tunnel along I-5 in the University City area, rather than deviating under UTC. However, it does so at the expense of being able to provide a station at UTC, a station whose underground location would make it costly and require deep tunneling under private property, but which is a significant population and employment center and an emerging regional transportation hub. The comparable "b" option station is at Solana Beach, which provides good intermodal access, but has less convenient freeway access and potentially constrained parking.

Option D1a is the least costly, about $1.2 billion less than the I-5 option. The "b" option involves extensive trenching and tunneling and approaches the cost of the dedicated I-5 option. For the extra capital cost, the "b" option provides a higher level of environmental mitigation by providing grade separations through Oceanside, Carlsbad, Encinitas, and downtown San Diego, and by moving the tracks away from the unstable bluffs at Del Mar.

The dedicated option (D2) provides a travel time similar to the LOSSAN options, of about 21 minutes, but does not go downtown. This time is more certain, since high-speed trains would not be sharing tracks with any other traffic. This option assures the possibility of no-transfer operations at LA Union Station.

Option D2 is also the costliest option, since the number and size of horizontal and vertical curves on I-5 require extensive aerial to maintain speeds. This option avoids the sensitive coastal areas. However, in many places, particularly at lagoon crossings, it is not very distant from the coast, and shares many of the environmental issues and sensitivities of the LOSSAN corridor. Due to the constrained right-of-way along the I-5 corridor, there exists the potential for impact to adjacent land uses, which are predominately commercial and industrial but include significant residential areas. Due to the need for aerial construction, there is significant potential for visual intrusion, particularly interference with ocean and lagoon views.

Station sites on the I-5 alignment would be problematic. Suitable land for stations is scarce, and the development of such new stations would be incompatible with the emerging Smart Growth principles of San Diego County, which stress the support and development of existing transportation hubs.

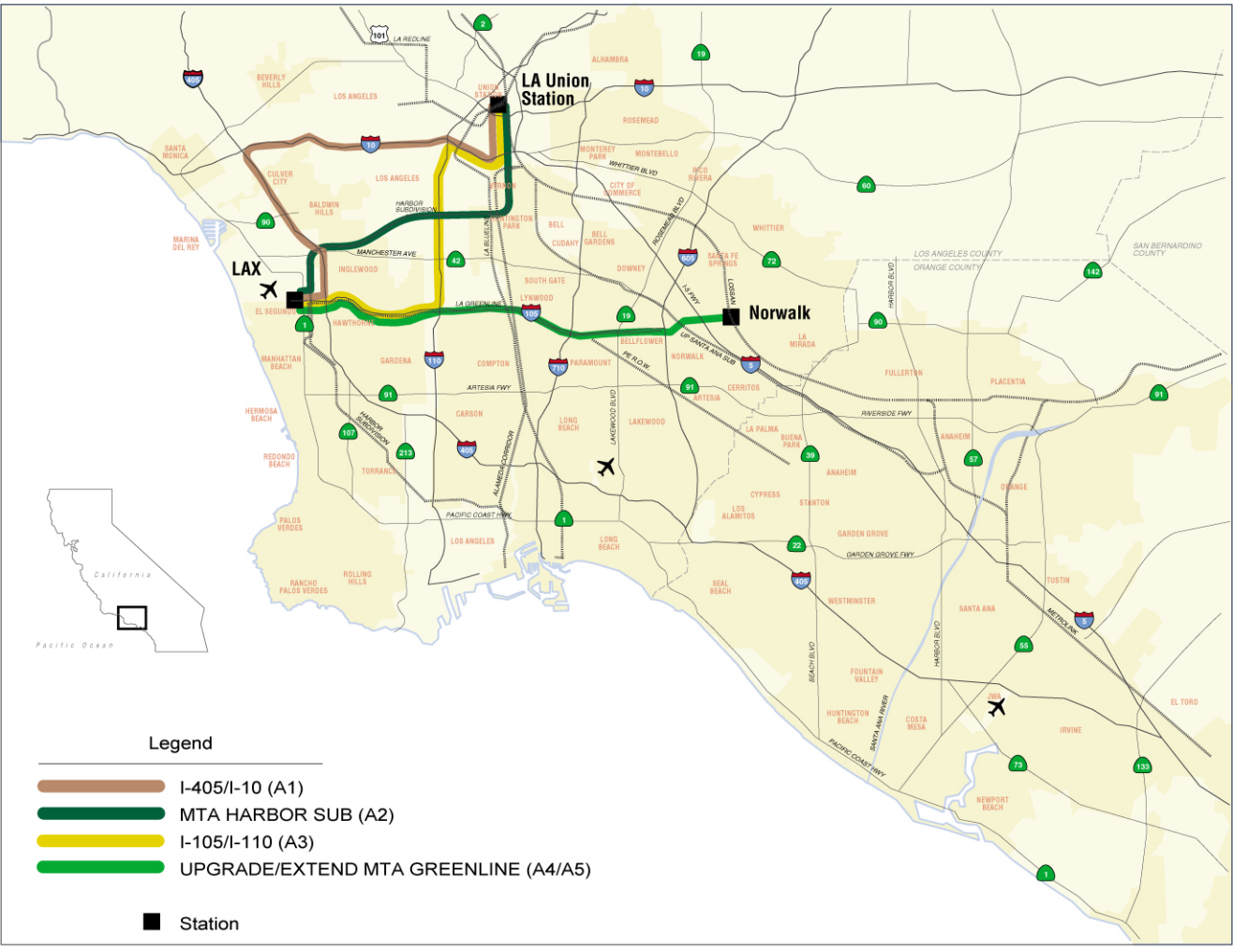
Also, as an I-5 alignment would be exclusively used by high-speed trains, the coastal communities would still be faced with issues in the LOSSAN corridor, and would in fact be hosting two parallel rail lines. It is highly likely that the communities would demand that the I-5 alignment be used by all rail services. This would diminish the performance of a high-speed train, raising questions about the cost-effectiveness of building a completely new infrastructure that is not fully dedicated to high-speed service. It would also force the relocation of all existing Amtrak and commuter rail stations into the I-5 corridor, likely causing significant disruption to abutting land uses.

Figure S-1

Proposed Alignment and Station Options

Figure S-2

Proposed Alternatives - LAX to LA Union Station - Segment A



ALIGNMENT A1

- *Dedicated track*
- *18.2 minutes*
- *23.2 miles (37.3 km)*
- *Highest cost*
- *Environmental Justice: Minority population of 105,000; 4,525 per Mile (2,815 per km)*
- *Impacts to several adjacent communities & neighborhoods*
- *Limited ROW*
- *Need to transfer at LAX*

ALIGNMENT A2

- *Dedicated track*
- *14.4 minutes*
- *15.8 miles (25.4 km)*
- *High cost*
- *Environmental Justice: Minority population of 43,000; 2,722 per Mile (1,693 per km)*
- *Impacts to several adjacent communities & neighborhoods*
- *ROW owned by MTA; may use as commuter line*
- *Need to transfer at LAX*

ALIGNMENT A3

- *Dedicated track*
- *17.0 minutes*
- *20.6 miles (33.2 km)*
- *Very high cost*
- *Environmental Justice: Minority population of 154,000; 7,475 per Mile (4,639 per km)*
- *Impacts to several adjacent communities & neighborhoods*
- *Limited ROW*
- *Need to transfer at LAX*

ALIGNMENT A4

- *Shared track with GreenLine/ shared capacity*
- *35 minutes*
- *21.1 miles (38.8 km)*
- *Environmental Justice: Minority population of 128,000; 6,066 per Mile (3,299 per km)*
- *Limited ROW*
- *Construction, Operational and Regulatory Fatal Flaws*
- *Need to transfer at LAX*

ALIGNMENT A5

- *Transfer to GreenLine*
- *35 minutes*
- *21.1 miles (38.8 km)*
- *Least cost*
- *Environmental Justice: Minority population of 128,000; 6,066 per Mile (3,299 per km)*
- *Double transfer*

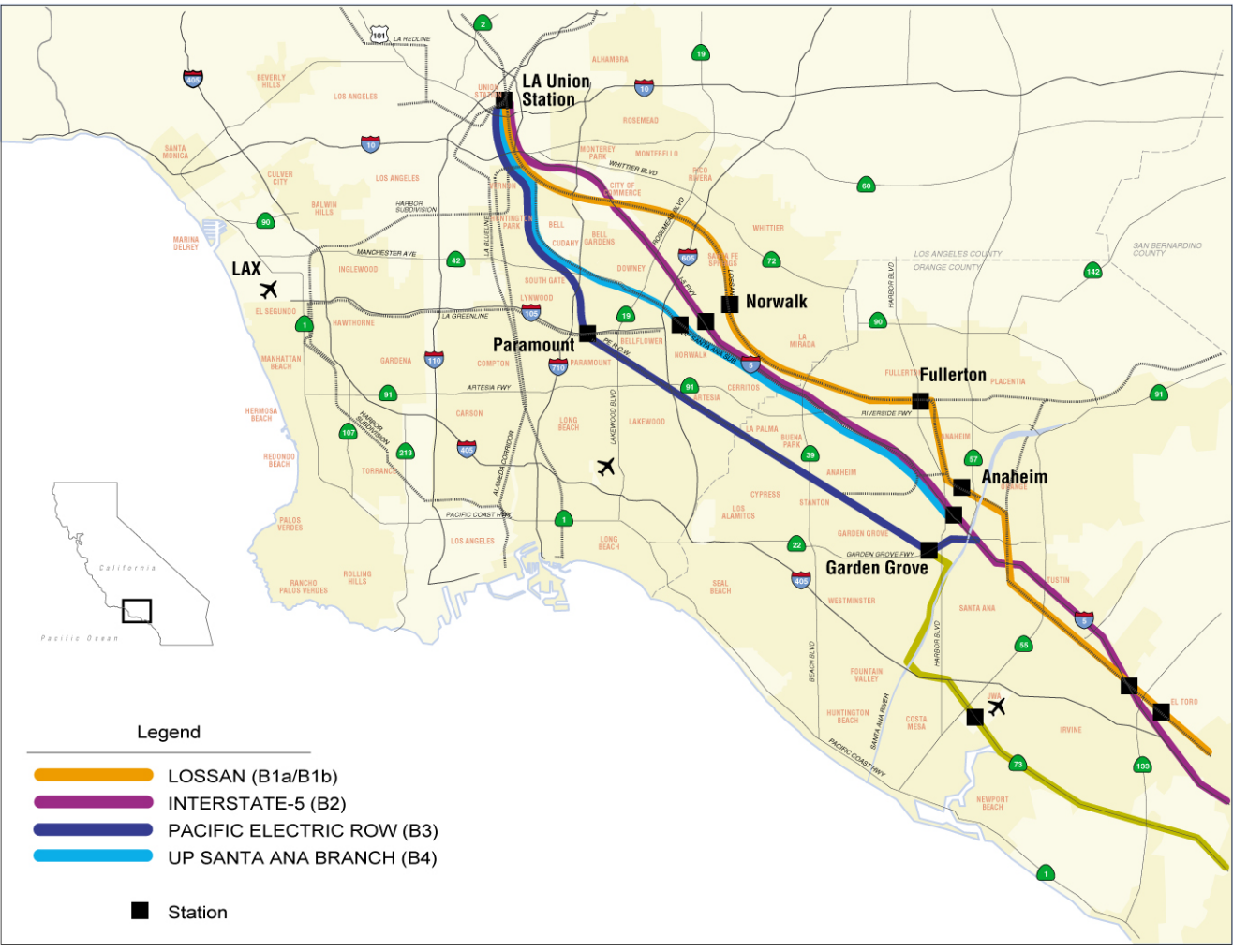
4 0 4 Miles

4 0 4 Kilometers

(Travel times given are express times only)

Figure S-3

Proposed Alternatives - Union Station to Central Orange County (Anaheim) - Segment B



ALIGNMENT B1a

- *Shared track/shared capacity*
- *19.4 minutes (longer in mixed traffic)*
- *30 miles (48.3 km)*
- *Least cost*
- *10,089,905 people served*
- *Environmental Justice: Minority population of 40,000; 1,333 per Mile (828 per km)*

ALIGNMENT B1b

- *Shared track/shared capacity*
- *18.3 minutes (longer in mixed traffic)*
- *30 miles (48.3 km)*
- *Moderate cost*
- *10,089,905 people served*
- *Environmental Justice: Minority population of 40,000; 1,333 per Mile (828 per km)*
- *Some ROW acquisition required*

ALIGNMENT B2

- *Dedicated track*
- *19.0 minutes*
- *28.3 miles (45.5 km)*
- *High cost*
- *10,367,191 people served*
- *Environmental Justice: Minority population of 78,000; 2.756 per Mile (1,714 per km)*
- *Second level aerial construction issues*
- *Limited ROW*
- *Southeast LA - station site abuts residential areas*

ALIGNMENT B3

- *Dedicated track*
- *16.4 minutes - fastest*
- *32.2 miles (51.8 km) - longest*
- *Highest cost*
- *10,890,544 people served*
- *Environmental Justice: Minority population of 89,000; 2,764 per Mile (1,718 per km)*
- *Weaker intermodal connections and freeway access*
- *Highest adjacent residential, particularly at stations*
- *Corridor being studied for local transit*

ALIGNMENT B4

- *Dedicated track*
- *17.1 minutes*
- *28.7 miles (46.1 km)*
- *High cost*
- *10,406,864 people served*
- *Environmental Justice: Minority population of 157,000; 5,470 per Mile (3,406 per km)*
- *Southeast LA - station site abuts residential areas*

4 0 4 Miles

4 0 4 Kilometers

(Travel times given are express times only)

Figure S-4

Proposed Alternatives - Central Orange County (Anaheim) to Oceanside - Segment C

ALIGNMENT C1a

- *Shared track/shared capacity*
- *33.9 minutes (longer in mixed traffic)*
- *55.5 miles (89.2 km)*
- *Least cost*
- *4,224,461 people served*
- *Construction & ROW issues in realigning existing tracks*
- *Remains in/near LOSSAN corridor in sensitive areas*
- *Several threatened & endangered species, parks and wildlife refuges along the coast*

ALIGNMENT C1b

- *Shared track/shared capacity*
- *32.1 minutes (longer in mixed traffic)*
- *56.1 miles (90.3 km)*
- *Moderate cost*
- *4,224,461 people served*
- *Construction & ROW issues in realigning existing tracks*
- *Deviates from LOSSAN corridor in sensitive areas*
- *Grade-separated construction in sensitive areas*
- *Several threatened & endangered species, parks and wildlife refuges along the coast*

ALIGNMENT C2

- *Dedicated track*
- *33.7 minutes*
- *55.1 miles (88.6 km)*
- *Very high cost*
- *4,714,864 people served*
- *Second level aerial construction issues*
- *Limited ROW*
- *Several threatened & endangered species along the coast*

ALIGNMENT C3

- *Dedicated track*
- *34.5 minutes*
- *57.6 miles (92.7 km)*
- *Highest cost*
- *4,841,680 people served*
- *Limited ROW along freeways*
- *Weaker intermodal connections and freeway access*

ALIGNMENT C4

- *Dedicated track*
- *36.6 minutes - slowest*
- *61.5 miles (99.0 km) - longest*
- *Very high cost*
- *4,714,864 people served*
- *Avoids sensitive areas in San Juan Capistrano and San Clemente*
- *Construction issues; Uncertainty as to the final alignment of SR-241*

4 0 4 Miles

4 0 4 Kilometers

(Travel times given are express times only)

Figure S-5

Proposed Alternatives - Oceanside to San Diego - Segment D

ALIGNMENT D1a

- *Shared track/shared capacity*
- *24.5 minutes (longer in mixed traffic)*
- *37.3 miles (60.0 km)*
- *Least cost*
- *2,609,220 people served*
- *Remains in/near LOSSAN corridor in sensitive areas*
- *Several threatened and endangered species, parks and wildlife refuges along corridor*
- *Unstable bluffs - Encinitas, Del Mar, Solana Beach*

ALIGNMENT D1b

- *Shared track/shared capacity*
- *23.2 minutes (longer in mixed traffic)*
- *35.8 miles (57.7 km)*
- *Very high cost*
- *2,217,289 people served*
- *Deviates from LOSSAN corridor in sensitive areas*
- *Several threatened and endangered species, parks and wildlife refuges along corridor*
- *Unstable bluffs - Encinitas, Solana Beach*

ALIGNMENT D2

- *Dedicated track*
- *21.4 minutes*
- *33.8 miles (54.5 km)*
- *Very high cost*
- *2,379,082 people served*
- *Third level aerial construction issues*
- *Does not address community concerns with existing rail service*
- *New stations are constrained and not generally compatible with adopted Smart Growth principles*
- *Significant right-of-way acquisitions issues*
- *Predominantly aerial - visual and barrier effects*
- *Several threatened and endangered species, parks and wildlife refuges along corridor*

4 0 4 Miles

4 0 4 Kilometers

(Travel times given are express times only)

Table S-1
Los Angeles to San Diego via Orange County – High-Speed Train Alignment Attainment of Objectives
LA Union Station/Southeast LA County to LAX Segment[4]

OBJECTIVE	Alignment Option A1	Alignment Option A2	Alignment Option A3	Alignment Option A5
Maximize Ridership/Revenue Potential	3	4	3	2
Maximize Connectivity and Accessibility	4	4	4	3
Minimize Operating and Capital Costs	1	2	1	4
Maximize Compatibility with Existing and Planned Development	3	4	3	4
Minimize Impacts to Natural Resources	3	2	3	3
Minimize Impacts to Social and Economic Resources	1	2	1	3
Minimize Impacts to Cultural Resources	2	2	2	3
Maximize Avoidance of Areas with Geologic and Soils Constraints	3	3	3	3
Maximize Avoidance of Areas with Potential Hazardous Materials	2	2	2	2

1 2 3 4 5
Highly Unfavorable Highly Favorable

[4] Option A4 is not included in the Attainment of Objectives Matrix.

Table S-2
Los Angeles to San Diego via Orange County – High-Speed Train Alignment Attainment of Objectives
LA Union Station to Central Orange County (Anaheim) Segment

OBJECTIVE	Alignment Option B1a	Alignment Option B1b	Alignment Option B2	Alignment Option B3	Alignment Option B4
Maximize Ridership/Revenue Potential	2	3	3	4	4
Maximize Connectivity and Accessibility	4	4	3	3	3
Minimize Operating and Capital Costs	5	4	2	1	2
Maximize Compatibility with Existing and Planned Development	3	3	2	2	2
Minimize Impacts to Natural Resources	3	3	4	3	4
Minimize Impacts to Social and Economic Resources	3	3	2	2	2
Minimize Impacts to Cultural Resources	3	3	3	4	4
Maximize Avoidance of Areas with Geologic and Soils Constraints	3	3	3	3	3
Maximize Avoidance of Areas with Potential Hazardous Materials	2	2	3	3	3

1 2 3 4 5
Highly Unfavorable — Highly Favorable

Table S-3
Los Angeles to San Diego via Orange County – High-Speed Train Alignment Attainment of Objectives
Central Orange County (Anaheim) to Oceanside Segment

OBJECTIVE	Alignment Option C1a	Alignment Option C1b	Alignment Option C2	Alignment Option C3	Alignment Option C4
Maximize Ridership/Revenue Potential	3	3	4	4	3
Maximize Connectivity and Accessibility	4	4	3	2	3
Minimize Operating and Capital Costs	4	3	1	1	2
Maximize Compatibility with Existing and Planned Development	2	3	3	3	3
Minimize Impacts to Natural Resources	2	2	2	2	2
Minimize Impacts to Social and Economic Resources	2	3	3	3	4
Minimize Impacts to Cultural Resources	1	2	3	3	3
Maximize Avoidance of Areas with Geologic and Soils Constraints	3	3	3	3	3
Maximize Avoidance of Areas with Potential Hazardous Materials	2	2	2	5	5

1 2 3 4 5
Highly Unfavorable — Highly Favorable

Table S-4
Los Angeles to San Diego via Orange County – High-Speed Train Alignment Attainment of Objectives
Oceanside to San Diego Segment

OBJECTIVE	Alignment Option D1a	Alignment Option D1b	Alignment Option D2
Maximize Ridership/Revenue Potential	3	4	4
Maximize Connectivity and Accessibility	4	3	2
Minimize Operating and Capital Costs	4	2	2
Maximize Compatibility with Existing and Planned Development	2	3	2
Minimize Impacts to Natural Resources	2	2	2
Minimize Impacts to Social and Economic Resources	2	3	3
Minimize Impacts to Cultural Resources	2	2	2
Maximize Avoidance of Areas with Geologic and Soils Constraints	2	3	3
Maximize Avoidance of Areas with Potential Hazardous Materials	2	2	3

1 2 3 4 5
Highly Unfavorable Highly Favorable

Table S-5
Los Angeles to San Diego via Orange County – High-Speed Train Alignment Attainment of Objectives
LA Union Station and LAX

OBJECTIVE	LAX	LA Union Station
Maximize Ridership/Revenue Potential	3	5
Maximize Connectivity and Accessibility	4	5
Minimize Operating and Capital Costs	2	3
Maximize Compatibility with Existing and Planned Development	4	4
Minimize Impacts to Natural Resources	5	5
Minimize Impacts to Social and Economic Resources	4	4
Minimize Impacts to Cultural Resources	5	4
Maximize Avoidance of Areas with Geologic and Soils Constraints	3	3
Maximize Avoidance of Areas with Potential Hazardous Materials	5	5

1 2 3 4 5
Highly Unfavorable Highly Favorable

Table S-6
Los Angeles to San Diego via Orange County – High-Speed Train Alignment Attainment of Objectives
Southeast LA County Stations

OBJECTIVE	Norwalk - LOSSAN	Norwalk - Interstate 5	Norwalk - Union Pacific	Paramount
Maximize Ridership/Revenue Potential	3	3	3	4
Maximize Connectivity and Accessibility	4	3	3	3
Minimize Operating and Capital Costs	4	3	3	2
Maximize Compatibility with Existing and Planned Development	4	3	3	2
Minimize Impacts to Natural Resources	5	5	5	5
Minimize Impacts to Social and Economic Resources	4	3	3	2
Minimize Impacts to Cultural Resources	5	5	5	5
Maximize Avoidance of Areas with Geologic and Soils Constraints	3	3	3	3
Maximize Avoidance of Areas with Potential Hazardous Materials	4	5	5	5

1 2 3 4 5
Highly Unfavorable Highly Favorable

Table S-7
Los Angeles to San Diego via Orange County – High-Speed Train Alignment Attainment of Objectives
Central Orange County Stations

OBJECTIVE	Anaheim - LOSSAN	Anaheim - Interstate 5	Garden Grove
Maximize Ridership/Revenue Potential	3	3	3
Maximize Connectivity and Accessibility	5	4	3
Minimize Operating and Capital Costs	4	2	2
Maximize Compatibility with Existing and Planned Development	4	3	2
Minimize Impacts to Natural Resources	3	3	3
Minimize Impacts to Social and Economic Resources	4	3	2
Minimize Impacts to Cultural Resources	5	5	5
Maximize Avoidance of Areas with Geologic and Soils Constraints	3	3	3
Maximize Avoidance of Areas with Potential Hazardous Materials	4	5	4

1 2 3 4 5
Highly Unfavorable Highly Favorable

Table S-8
Los Angeles to San Diego via Orange County – High-Speed Train Alignment Attainment of Objectives
Southern Orange County Stations

OBJECTIVE	Irvine - LOSSAN	Irvine - Interstate 5	Newport Beach
Maximize Ridership/Revenue Potential	3	3	4
Maximize Connectivity and Accessibility	4	3	2
Minimize Operating and Capital Costs	4	3	2
Maximize Compatibility with Existing and Planned Development	4	3	2
Minimize Impacts to Natural Resources	4	4	3
Minimize Impacts to Social and Economic Resources	4	4	3
Minimize Impacts to Cultural Resources	5	5	5
Maximize Avoidance of Areas with Geologic and Soils Constraints	3	3	3
Maximize Avoidance of Areas with Potential Hazardous Materials	5	5	5

1 2 3 4 5
Highly Unfavorable Highly Favorable

Table S-9
Los Angeles to San Diego via Orange County – High-Speed Train Alignment Attainment of Objectives
North San Diego County Stations

OBJECTIVE	Oceanside - LOSSAN	Oceanside - Interstate 5
Maximize Ridership/Revenue Potential	2	2
Maximize Connectivity and Accessibility	4	3
Minimize Operating and Capital Costs	4	3
Maximize Compatibility with Existing and Planned Development	3	2
Minimize Impacts to Natural Resources	3	3
Minimize Impacts to Social and Economic Resources	4	3
Minimize Impacts to Cultural Resources	3	3
Maximize Avoidance of Areas with Geologic and Soils Constraints	3	3
Maximize Avoidance of Areas with Potential Hazardous Materials	4	5

1 2 3 4 5
Highly Unfavorable Highly Favorable

Table S-10
Los Angeles to San Diego via Orange County – High-Speed Train Alignment Attainment of Objectives
Central San Diego County Stations

OBJECTIVE	Solana Beach - LOSSAN	Solana Beach - Interstate 5	University Towne Centre
Maximize Ridership/Revenue Potential	2	2	3
Maximize Connectivity and Accessibility	3	2	4
Minimize Operating and Capital Costs	3	2	1
Maximize Compatibility with Existing and Planned Development	4	2	3
Minimize Impacts to Natural Resources	5	4	3
Minimize Impacts to Social and Economic Resources	3	3	3
Minimize Impacts to Cultural Resources	3	3	3
Maximize Avoidance of Areas with Geologic and Soils Constraints	3	3	2
Maximize Avoidance of Areas with Potential Hazardous Materials	5	5	5

1 2 3 4 5
Highly Unfavorable Highly Favorable

Table S-11
Los Angeles to San Diego via Orange County – High-Speed Train Alignment Attainment of Objectives
San Diego Airport and Santa Fe Depot

OBJECTIVE	Santa Fe Depot	San Diego Airport
Maximize Ridership/Revenue Potential	4	4
Maximize Connectivity and Accessibility	4	3
Minimize Operating and Capital Costs	4	3
Maximize Compatibility with Existing and Planned Development	3	3
Minimize Impacts to Natural Resources	5	5
Minimize Impacts to Social and Economic Resources	5	4
Minimize Impacts to Cultural Resources	3	4
Maximize Avoidance of Areas with Geologic and Soils Constraints	3	3
Maximize Avoidance of Areas with Potential Hazardous Materials	5	4

1 2 3 4 5
Highly Unfavorable Highly Favorable